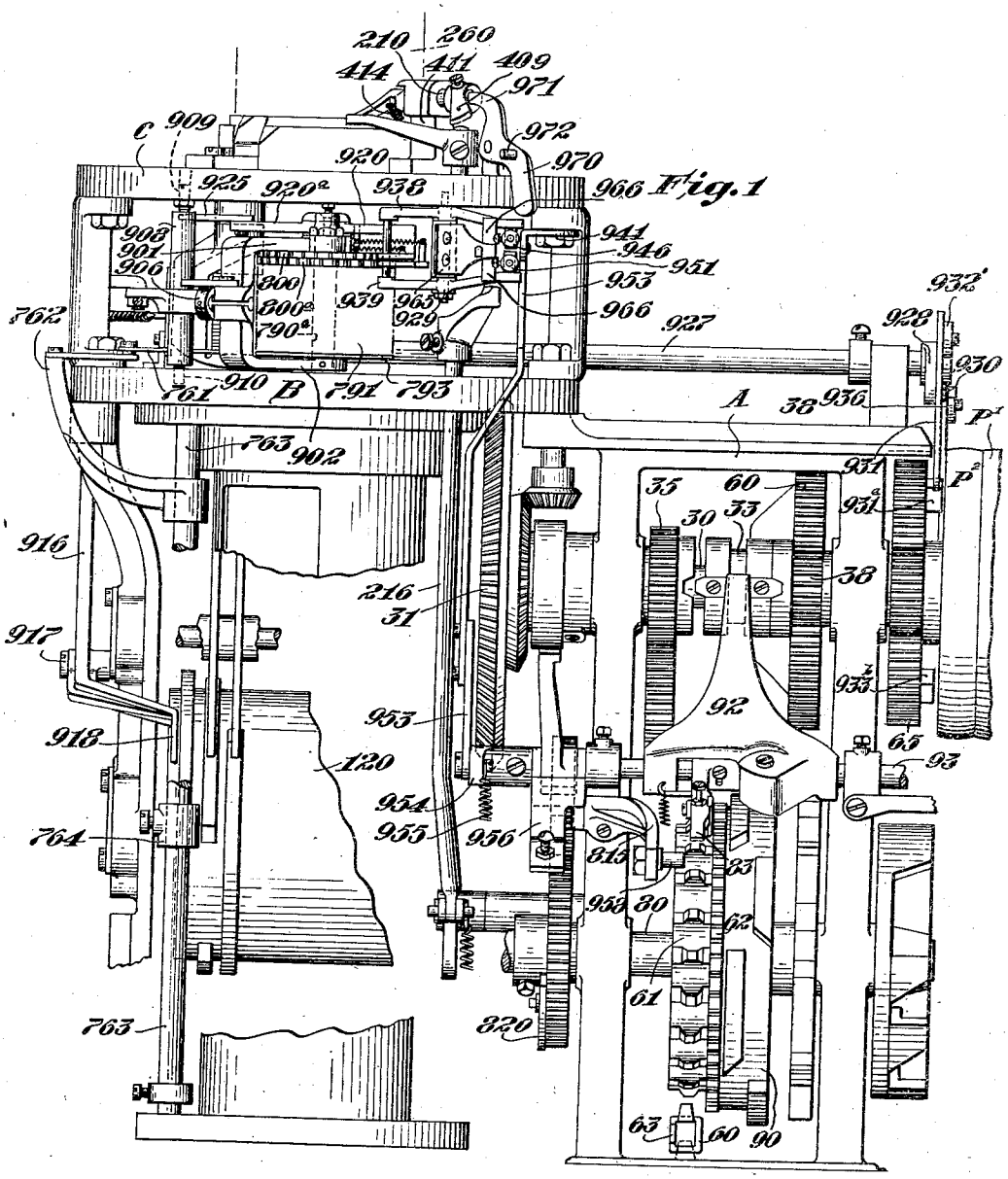
May 19, 1936. E. W. MARSHALL ET AL 2,040,946

KNITTING MACHINE

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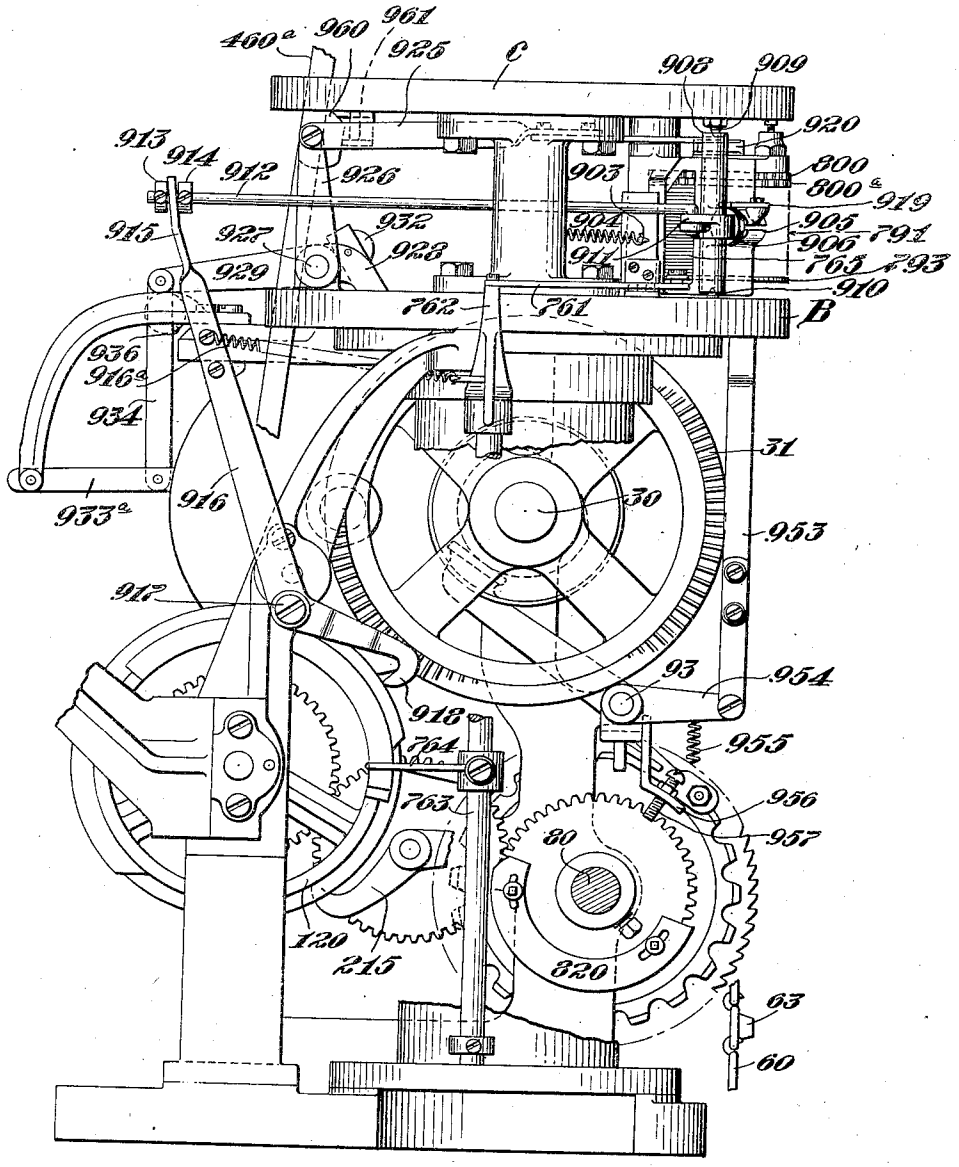
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KNITTING MACHINE

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Fig. 2



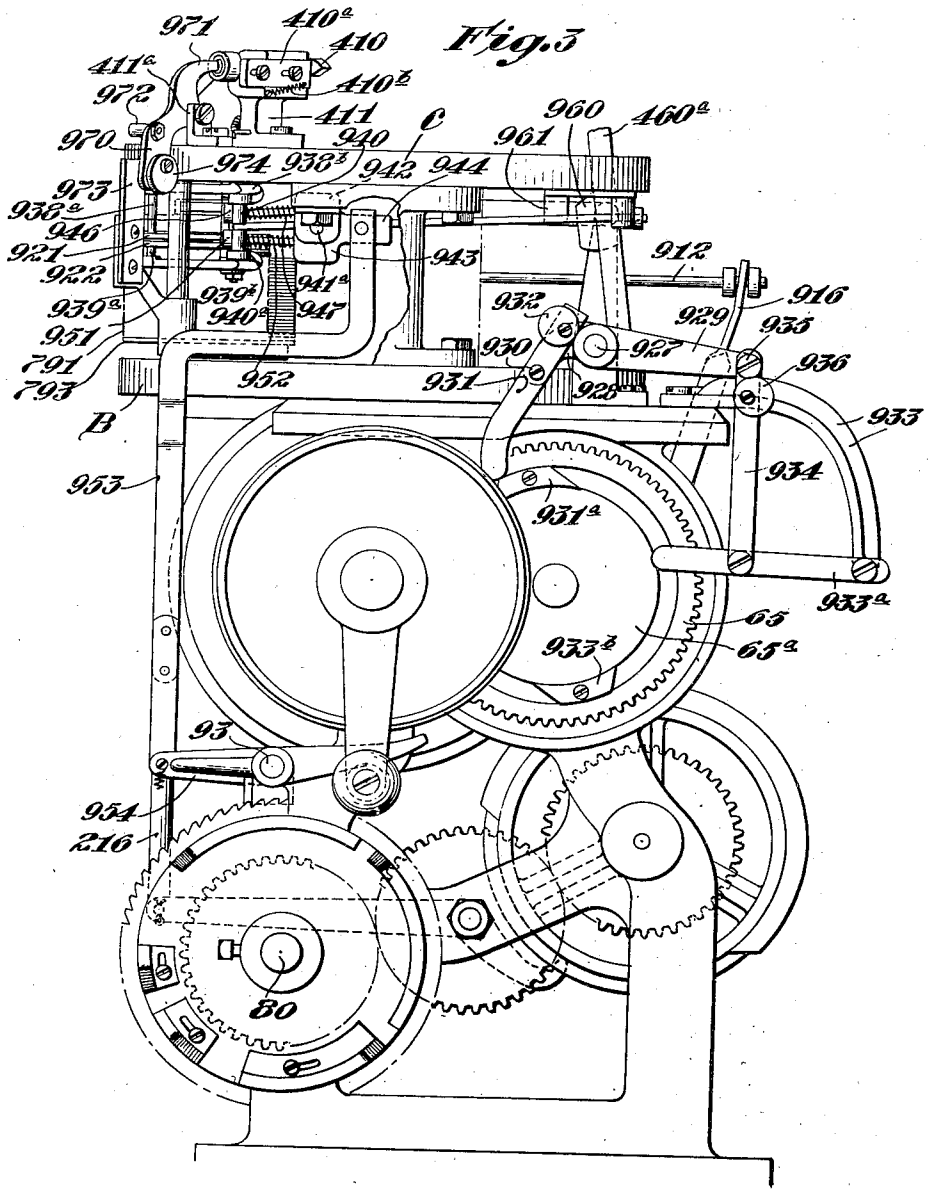
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Fig. 3



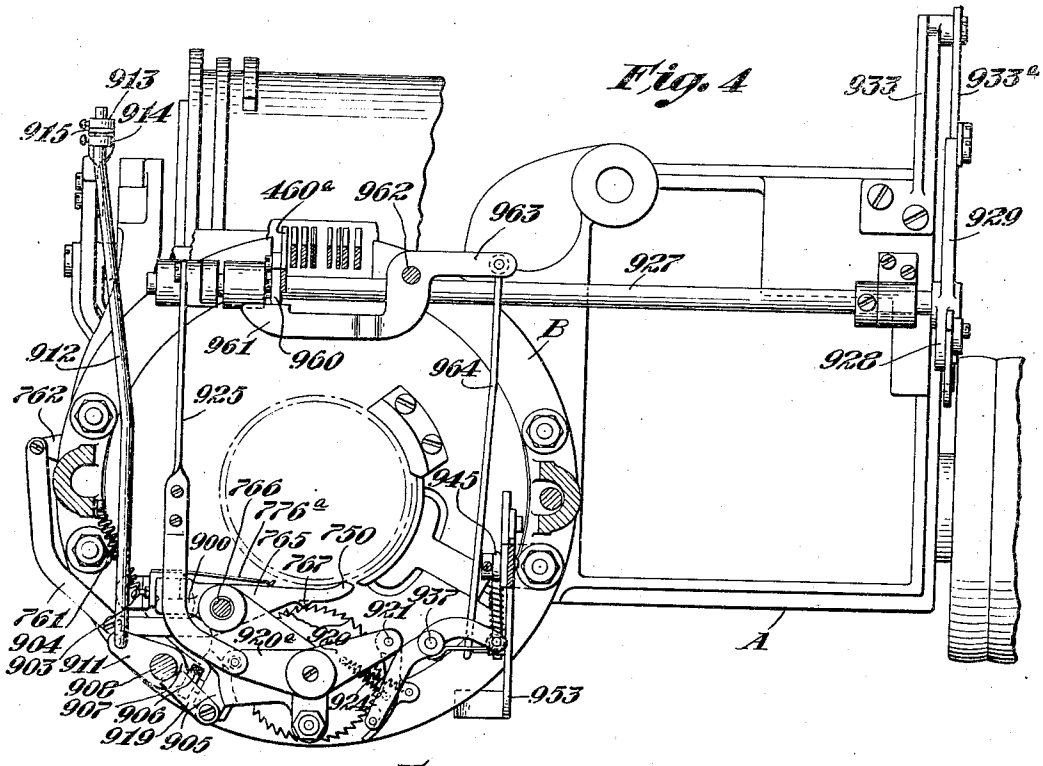
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Fig. 4



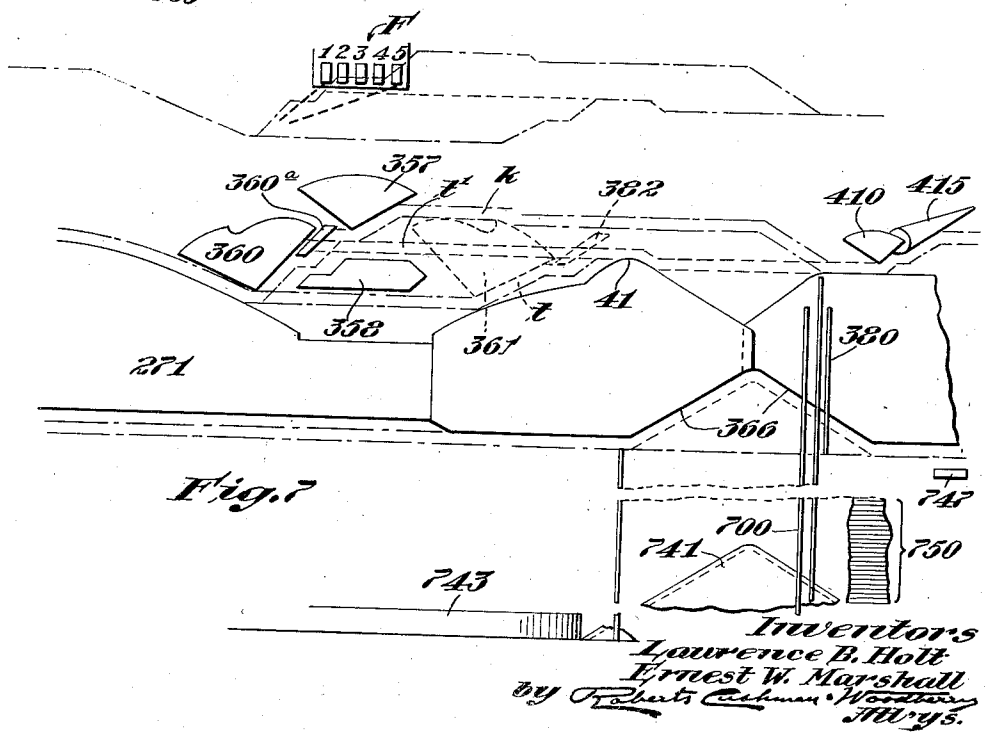


Fig. 7

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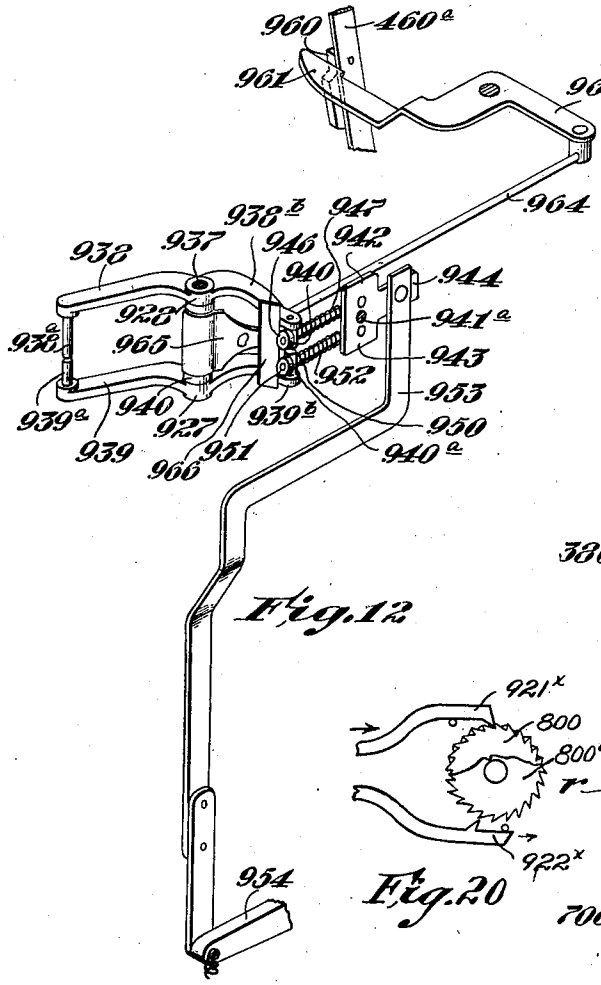


Fig. 12

Fig. 20

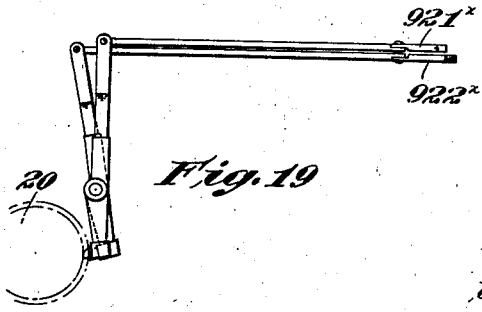


Fig. 19

Fig. 5

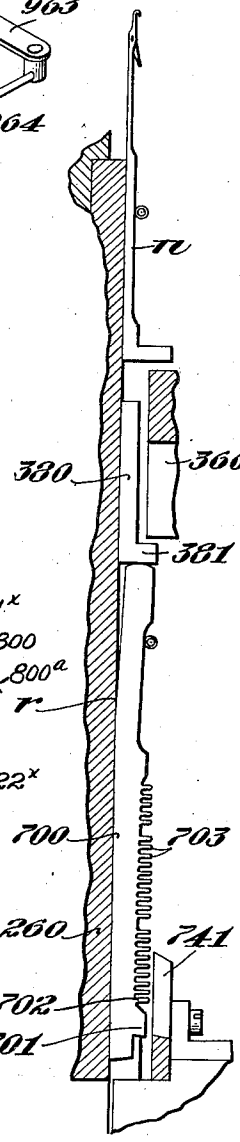
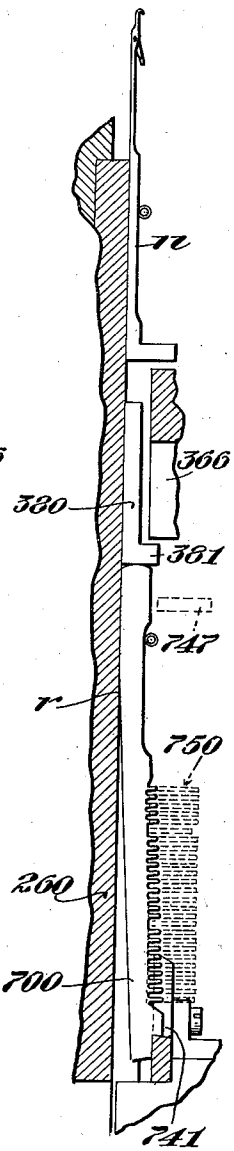


Fig. 6



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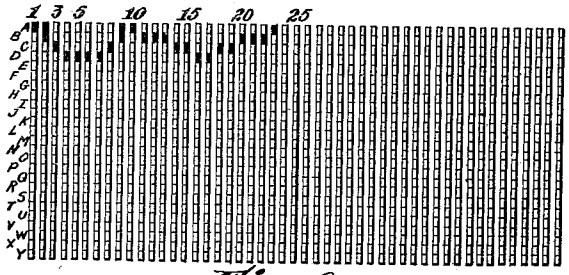


Fig. 9

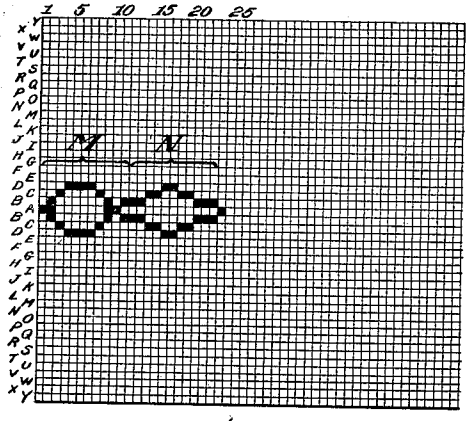


Fig. 10

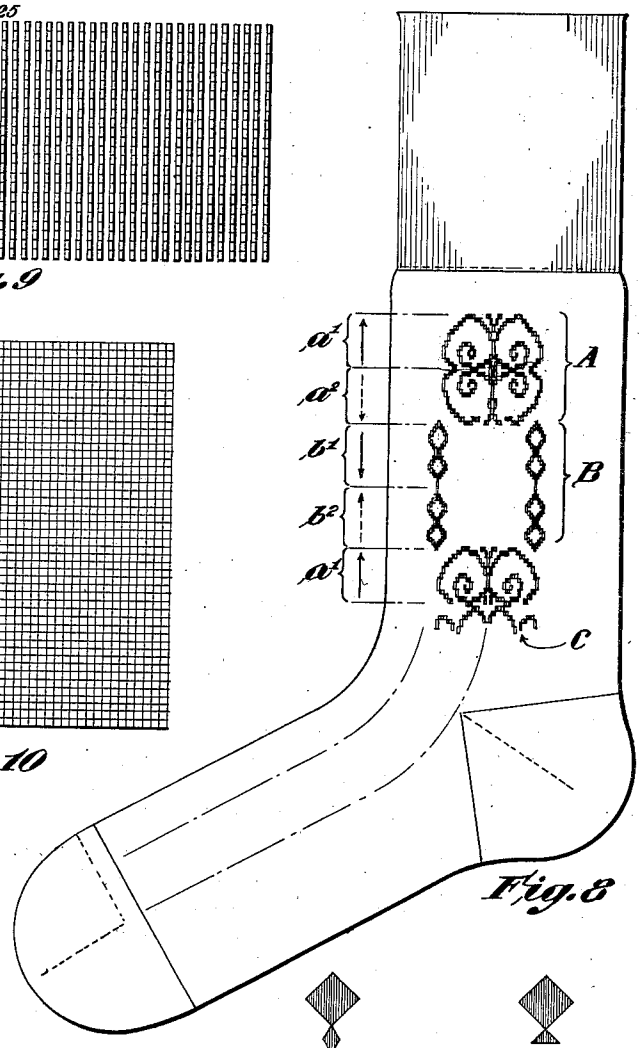


Fig. 8

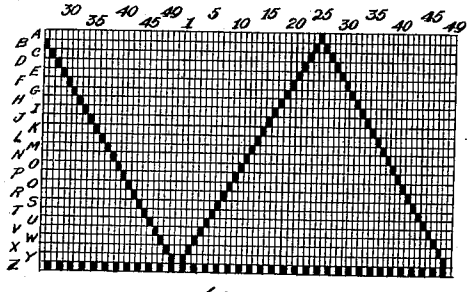


Fig. 11

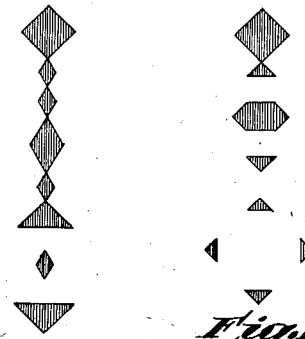


Fig. 17

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KNITTING MACHINE

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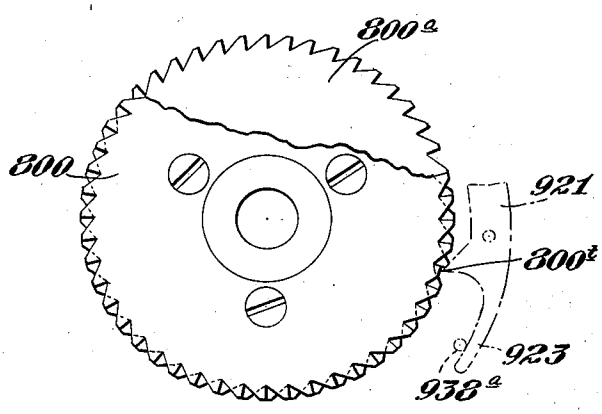


Fig. 13

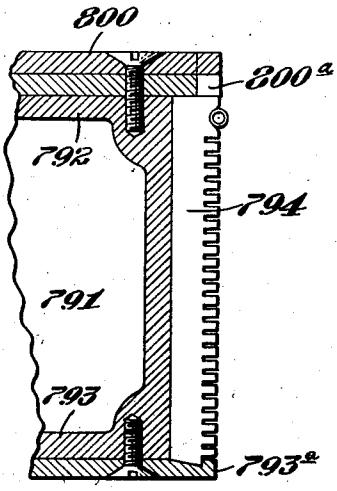


Fig. 16

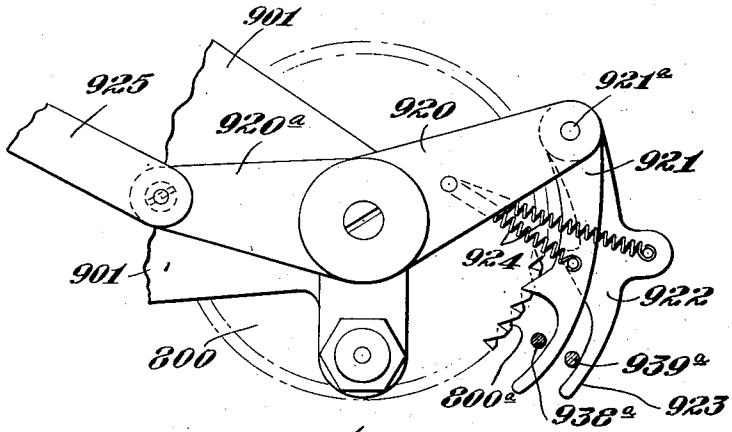


Fig. 14

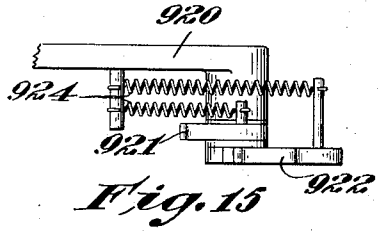


Fig. 15

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Patented May 19, 1936 2,040,946

UNITED STATES PATENT OFFICE

2,040,946

KNITTING MACHINE

Ernest W. Marshall and Laurence B. Holt, Laconia, N. H., assignors to Scott & Williams, Incorporated, New York, N. Y., a corporation of Massachusetts

Application March 2, 1933, Serial No. 659,272

18 Claims. (Cl. 66—50)

This invention pertains to knitting machines and relates more especially to fabric-patterning mechanism for such machines. While useful in knitting machines of other types, the present improvements are particularly useful in hosiery machines wherein the production of pattern effects in the fabric must not interfere with the normal sequence of certain predetermined operations necessary in the production of a stocking,—for example, the formation of a heel and toe.

One machine, of a kind to which the present invention may desirably be applied and in connection with which it will be described, is any machine of the well known Scott & Williams type, for example, as built under the United States patents to Robert W. Scott, No. 1,148,055, dated July 27, 1915; No. 1,282,958, dated October 29, 1918; No. 1,256,062, dated February 12, 1918; and No. 1,237,256, dated August 14, 1917; or under the United States patent to Grothey, No. 1,678,385, dated July 24, 1928.

In the Grothey patent just referred to, there is disclosed a patterning mechanism of desirable form which is applicable to hosiery machines without interference with their normal functions and which is designed to select and actuate the knitting instrumentalities to form pattern variations in the fabric made by them. For this purpose provision is made for selection of individual needles normally to take and knit with, or occasionally to miss or to float (or tuck with) yarns fed to them at their stitch making point, according to the movements of selector jacks in the needle grooves adapted to be rocked in their grooves, and having differently positioned butts, as a consequence of the position of a movable reader cam, which cam causes the jacks to miss or to be raised by an advancing cam and thereby in turn to move their needles to normal or special positions in the machine at each course. In the Grothey device the reader cam is actuated in accordance with a certain predetermined pattern which may be made up by mutable pattern indications on a movable auxiliary pattern surface or drum, such pattern indications being adapted to cause, at different positions of the auxiliary pattern surface or drum, the selection by the reader cam of a different jack or series of jacks (and therefore needle or series of needles) to take a fully operative or differently operative, or inoperative path in respect to one at least of yarns fed for knitting, so as to float or tuck, or not to float or to tuck at any needle in one or more courses.

In the Grothey device the auxiliary pattern drum is provided with means for driving it always in the same direction, and so long as the pattern drum continues to operate, it will reproduce the same pattern or sequence of patterns over and over again in the fabric, although provision is made for throwing the reader cam out of action at times, thus permitting the patterning effect to be stopped at will.

One object of the present invention is so to improve upon prior mechanism, for example, that disclosed in said Grothey patent, as to permit reversal of the auxiliary pattern drum or surface at any time so that the drum or surface may be driven forward or reawardly through any desired angle of movement, thereby permitting a pattern to be made in the forward direction of the drum and then, for example, a reverse repeat of the pattern to be made by turning the drum in the opposite direction. This arrangement greatly increases the possibilities of fabric ornamentation without undesirably increasing the dimensions of the pattern surface.

The present invention further seeks to simplify the mechanism employed for causing cessation of pattern formation at any desired point in the operation, whether the pattern drum be turning in the forward or in the reverse direction, and without operatively interfering with the drive of the auxiliary pattern drum. By this means it is possible to make a pattern figure or portions of such figure in the advance direction through as many repeats as desired;—then to make the same figure in reverse direction through as many repeats as desired, and at any point to leave an unpatterned area in the fabric of as long extent as may be wished before starting a new repeat of the pattern. In obtaining these results, as well as many other pattern effects which will be apparent to those skilled in the art, I employ a 'trick wheel" or auxiliary pattern drum rotatably mounted upon a movable support, and provide pattern controlled connections for moving this support into and out of operative position, thereby to cause cessation of the pattern forming action or its initiation at any desired point in the length of the knitted fabric. Furthermore, to permit the formation of reversed pattern repeats, I provide driving means for the auxiliary pattern drum or trick wheel, so arranged that such drum may be driven in either direction and for any length of time desired, after which it may be driven in the reverse direction. This mechanism preferably comprises two sets of driving pawls and ratchets with pattern

control devices for determining the pawl which at any time shall be in operative relation to its ratchet. The pattern controlled connections for operating these pawls and for moving the trick wheel in and out of action, as well as various other new and useful details of construction, will hereinafter be more full described and set forth at length by reference to the accompanying drawings, wherein one desirable embodiment of the invention is illustrated by way of example, and in which

Fig. 1 is a front elevation showing devices according to the invention as applied to a Scott & Williams machine adapted to make stockings with float stitch patterns;

Fig. 2 is a left side elevation of the machine according to Fig. 1;

Fig. 3 is a corresponding right side elevation;

Fig. 4 is a plan view, partly in horizontal section, in a plane above the lower bed plate, showing details of the present invention;

Figs. 5 and 6 are diagrammatic vertical sections, on radial planes of the needle carrier, showing needles, needle jacks and selector jacks typical, respectively, of positions for determining a float stitch and a plated body fabric at the needles there illustrated;

Fig. 7 is an internal development illustrating one arrangement of cam devices for operating the needles, needle jacks, and selector jacks;

Fig. 8 is a diagrammatic side elevation illustrating a typical product of the machine;

Fig. 9 is a diagram illustrating a suitable layout of jack butts on the selector jacks for producing a given pattern;

Fig. 10 is a diagram illustrating the special stitches concerned in such selected pattern;

Fig. 11 is a diagram showing the arrangement of the tricks or indications on the pattern drum or trick wheel for producing the pattern of Fig. 10;

Fig. 12 is a fragmentary perspective view illustrating some of the connections provided for controlling the motion of the trick wheel;

Fig. 13 is a plan view of the trick wheel, to larger scale, showing the two ratchet wheels or disks, the upper disk being broken away;

Fig. 14 is a plan view of the trick wheel showing portions of the supporting device for the latter, and illustrating the arrangement of driving pawls and pawl controllers;

Fig. 15 is a fragmentary elevation of the pawls shown in Fig. 14 with a portion of the pawl carrier together with the actuating springs;

Fig. 16 is a fragmentary radial section through the trick wheel showing one of the patterning bits therein;

Figs. 17 and 18 are diagrams illustrating some of the possible combinations which can be made from a simple pattern figure or parts thereof by the apparatus herein disclosed;

Fig. 19 is a diagrammatic view, illustrating a modified mechanism for controlling and driving the trick wheel; and

Fig. 20 is a fragmentary plan view, showing the relative arrangement of the pawls of Fig. 19 and the respective ratchet wheels.

Referring to the drawings, the machine may be a circular machine and comprise in the preferred form devices for performing all of the usual stocking knitting functions; for example, for making in succession separate stockings each having an integral inturned welt or hem, or an integral ribbed top;—the product may have any of the usual features of the knit stockings including a leg fashioned by variation of stitch length and having usual areas of reinforced or spliced fabric, and having reciprocally knit narrowed and widened heels and toes of any desired construction. As shown, the machine comprises a frame A (Fig. 1) which houses and supports driving and motion changing devices, primary and main pattern devices, etc. This frame also supports an overhanging bed plate B having a horizontal needle carrier driving gear, not shown, having bearings in said plate and carrying a splined sleeve constituting a mounting for the needle carrier. The bed plate B provides a support for selector device operating means and may in turn support an annular bed plate C carrying the usual needle controlling cams, cam ring, picker mechanism, web-holder mechanism, latch guard ring, instrument dial, if any, and yarn feeding devices, appurtenant to the particular kind of hosiery or other machine to which this invention may be applied.

The grooved needle carrier **260** (Figs. 1, 5 and 6) is a longer cylinder than is usual for circular knitting machine needle carriers and provides long tricks or grooves for the usual needles *n* which may be any kind of needles, shown as latch needles having their hooks forward of the rear line of their shanks. These long grooves also receive needle jacks **380** having operating butts **381** and also selector or pattern jacks **700**. These latter jacks preferably have a rocking point at *r* on their backs and operating butts **701**, as described, for example, in the Grothey patent above referred to so that their butt carrying portions are movable radially in the grooves. The selector jacks **700** are in the lower part of the carrier **260** with their butts exposed between the bed plates B and C, this part of the carrier thus constituting a pattern cylinder, the arrangement of the butts of the jacks disposed therein primarily determining the pattern which at any time is to be knit. The instruments for operating these jacks are preferably mounted in the spaces between said bed plates. The usual instruments for hosiery machine needle control which are carried by the bed plate C may operate in the usual manner and in response to the usual mechanisms, except as hereinafter specifically referred to.

The needles and web holders operate in the upper part of the cylinder **260**. As is customary, the activities of the machine are in the first instance controlled by a primary pattern surface, for example, a mutable link chain **60** trained over a sprocket **61** integral with or attached to a ratchet **62** loose on the main pattern shaft **80**. This ratchet is moved forward by a pawl, (not shown) one tooth at each of several, for example four, revolutions of the main shaft **30** which carries the driving bevel gear **31** for turning the needle cylinder. The shaft **80** carries the drum **90** having cam elements adapted to shift a yoke **92** (Fig. 1) mounted on a slide rod **93** and by means of this yoke to actuate a clutch **33** adapted alternatively to connect the shaft **30** either to the reciprocating pinion **35** or to the rotating pinion **38**. This latter pinion may be driven by a tubular axle from the pulley P′ (Figs. 1 and 3), or indirectly at an increased speed by means of the pulley P^2 through gearing comprising gears **65** and **60**, all in the usual manner. Motions of shaft **80** and main pattern drum **120** which is geared to it, are in consequence of the coaction of a reciprocating pawl with a rack wheel (not shown) as determined by a pawl controller **83** mounted on the slide shaft **93**, such pawl controller being po-

sitioned by suitable lugs carried by links of the chain 60. This chain is illustrated as furnished with a series of lugs 63 at its left hand side, (Fig. 1) corresponding to places in the length of the fabric at which the operation of the pattern devices is to be modified.

Cams mounted directly on and rotating with the main pattern surfaces represented by the shaft 80 and its adjuncts are relied upon to control the devices at the knitting head, or above the bed plate C for the usual activities of the machine in knitting a stocking. The shaft 80 and the drum 120 turn through one complete revolution during the production of each article, but auxiliary pattern surfaces, not shown, may be provided if desired and in accordance with the usual practice for producing, for example, occasional or special motions of the yarn fingers for making stripes or other colored patterns.

This machine is particularly well adapted to knit patterns comprising distributed stitches containing floats of one at least of two yarns caused to pass to the back of the fabric and comprising at this stitch a tucked loop of the other yarn or yarns; or patterns containing wales or series of missed stitches; or patterns having normal areas of plated fabric ornamented by patterns of stitches of the concealed yarn of the plating couple, made as the result of floating the plating yarn behind a stitch of the body or normally concealed yarn.

All of the desired conditions for patterning the fabric may be satisfied by providing for a pattern controlled separation of a selected needle from its normal path whereby to cause such needle to miss operative contact with the yarn not to be taken by it at its next passage from the stitch cam; or to cause it to take a new yarn without having cleared its previous loop; or to cause it to pass in front of one yarn of a plating couple of which it takes and knits the other yarn. By appropriate position of cam paths, any of these operations may follow as a consequence of providing for lifting all of the needles n, except pattern selected needles, at any point ahead of the stitch cam and yarn feed.

For example, referring to Fig. 7, the machine may comprise the usual stitch cams 360 and 361 with the top center cam 357, and, if desired a bottom center cam 358, and in conjunction therewith, riser cams on the cam ring 271 arranged to lift the butts of needles n at the point 41 to the tuck point at which previous loops are not cleared. A switch cam 415 and a guard cam 410 are provided for the usual purposes in stocking knitting.

The switch cam 415 is arranged to move in and out radially of the cam cylinder and also to rock up and down whereby to permit it to perform its usual functions in switching needles to and from the idle path, for example, in the knitting of heels, toes and split foot stockings. This cam 415 is carried by a spindle 210 (Fig. 1) mounted in bearings in a bracket 411 carried by the bed plate C. A tension spring 414 tends to turn the point of the cam 415 downwardly and also to retract the cam radially away from the needle cylinder. The spindle 210 is provided with a laterally projecting arm or wing 409 which is disposed in the path of vertical movement of the upper end of a gravity rod 216 connected at its lower end to one arm of a bell crank lever whose other arm 215 (Fig. 2) lies in the path of a series of cams on the pattern drum 120. A second bracket 411a (Fig. 3) on the bed plate C pivotally supports a bell crank lever having a vertical arm 970 and a horizontal arm 971, the latter being aligned with the cam spindle 210.

The vertical arm 970 has a lateral stud 972 disposed in the vertical path of movement of the upper end of a bracket 973 of adjustable length carried by the rod 216. The lower end of the arm 970 is provided with an adjustable eccentric stop 974 (Fig. 3) adapted to engage the edge of bed plate C to limit outward movement of the cam spindle 210. Guard cam 410 is mounted upon a slide plate 410a supported by the bracket 411 and which is normally retracted outwardly from the needle cylinder by a spring 410b.

With the arrangement just described, upward movement of the gravity rod 216 will produce a simultaneous rocking of the cam spindle 210 and an inward movement of the latter, and in accordance with the relative heights of the cams which engage the lever arm 215, or the absence of cams engageable with said lever arm, the switch cam 415 may be disposed in any desired operative position.

A dividing cam 382 may upon occasion be moved into contact with butts of needles n to switch them below the leading stitch cam 361 and the center cam 358 so that they follow the path t. Such needles thereupon pass yarns fed from any of the fingers 1, 2, 3, 4 or 5 of the series F of yarn feed guides without contacting the new yarn until after knitting at the lower point of cam 360. The cams 361 and 382 may be severally removed radially out of contact with the butts of needles n. In the latter case the needles, after passing the tuck point 41, maintain their level at the tuck position and move along the path t' until they contact with either the face of the stitch cam 360 or a supplemental cam 360a which may be inserted to depress needles at an earlier time in respect to a main or body yarn fed by fingers 1 or 2 to needles taking a normal path at k. When needles travel in the path t' they do not operatively take a plating yarn fed at a considerable lead, for example from finger 5, but will take the main yarn from fingers 1 or 2 by the movement of their neighboring needles as determined by the cams 360a or 360. Needles moving in path k take both yarns in plating relation, while stitches made by needles following the path t' show an internal float of yarn from fingers 4 or 5, disposed behind a face loop of body yarn from fingers 1 or 2. If these needles have had their latches cleared, this face loop is an ordinary loop; if these needles are only cleared at intervals of several courses such face loops are tuck loops; but if the latches have been cleared and the cams adjusted to cause the needles to take the path t then such needles will receive no new yarn and will drop their stitches.

The machine may comprise a clearing cam (not shown) operating ahead of the switch cam 415, and when this is in use, needles taking the path t' show the color of yarn from fingers 1 or 2, whereas the needles taking the path k show loops regularly plated on their faces with yarn from fingers 4 or 5. On the other hand, needles in path t either retain previous loops or cast off depending on whether they have been cleared.

The needles are distributed in the several paths by the operation of the needle jacks 380 at the cam surfaces 366, and this operation of the jacks 380 is in turn controlled by the selector jacks 700. As shown in Figs. 5, 6 and 7, the bed plate B supports a cam 741, preferably beveled (Fig. 5)

to engage undercuts on the selector jack butts **701**, and this cam **741** is arranged to raise or advance any jack **700** which reaches it in the position shown in Fig. 6. The selector jack, thus advanced lifts the corresponding jack **380** so as to elevate its needle to the path *k*. If the cam **361** is in operation, no pattern can be knit since all of the needles reach the path *k* before arriving at the knitting point. Before the jacks **700** reach the cam **741**, their lower ends are rocked outwardly by a cam **747** into the field of action of cam **741**, and they are thereafter acted upon selectively to return some of them out of reach of cam **741** by reader cam levers **765** arranged in a vertical stack or series, such reader cam levers having cam ends **750** which are operative upon the selector jack butts at a point ahead of the position of cam **741**. Elsewhere than opposite the cams **741**, **747** and **750**, the jacks **700** may be retained in the position of Fig. 5 by a ring **743** (Fig. 7).

Referring now to Figs. 1, 2, 5 and 6, the selector jacks **700** are initially provided with a series (of which there may be twenty-five or more) of spaced butts **702**, **703** extending from just above the operating butt **701** to a point somewhat below the rocking point *r*.

The operation of the following slope **366** upon the butts of jacks **380** levels the selector jacks **700** after passing the cam **741**. Any one or more of the butts **702**, **703** may be removed when desired, as by breaking it off from any selected jack or jacks, so as to provide a butt space or spaces at one or more of the twenty-five different levels at which the butts are normally located. A reader cam **750** disposed at any level at which a jack butt has been removed will be ineffective to move the corresponding jack so that such jack will be raised by the cam **741** so as to carry its needle up to the normal path *k*. On the other hand, a reader cam disposed at any level at which the jack butt has not been removed will move the corresponding jack radially inwardly so as to escape the cam **741**, whereupon the corresponding needle will take the path *t'* or *t*, depending upon the position of cams **382** and **361**. If, for example, at the fifth butt level from the bottom, each twentieth jack, only, has a butt, a reader cam at this butt level will be ineffective to move any of the jacks except the twentieth ones, and thus all needles except each twentieth one will rise to the normal path *k*,—each twentieth jack being moved radially by engagement of the reader cam with the jack butt so as to escape the riser cam **741**, and thus its needle will take the path *t* or *t'*, thereby producing a vertical float stripe on each twentieth needle. However, this stripe may be intermitted or stopped by moving the corresponding jacks away from the cam **741** by any of their other butts.

The lowest butts **702** may be present on alternate jacks and may be operated upon by the cam end of a lever (not shown) pivoted on bed plate B for the purpose, in connection with dividing cam **382** (Fig. 7), of sending alternate needles under the stitch cams for making starting selvages; to permit ribbing; and for other purposes having to do with the structure of products familiar to users of the said Scott & Williams machines. This lever may be worked by a link **761**, (Fig. 4), arm **762**, vertical shaft **763** (Fig. 2), and arm **764** taking against a cam surface on the end of main pattern drum **120**.

Opposite the levels of the respective butts **703**, a vertical stack or series of pattern indication transmission devices, herein referred to as "reader cam" levers **765**, are pivoted to swing in horizontal planes on a vertical shaft **766** extending between the bed plates B and C. Each of these reader cam levers **765** is provided with a cam end **750** disposed at the level of one of the rows of butts **703**, while the opposite side of the lever is furnished with a projecting lug **767** (Fig. 4).

The shaft **766** on which the fingers **765** are mounted also carries a housing having a vertical portion **900** (Fig. 4) uniting upper and lower plates **901** and **902** (Fig. 1) between the planes of which the stack of levers **765** is arranged. The housing, comprising the parts **900**, **901** and **902** is adapted to swing about the vertical shaft **766**, as an axis, and the vertical member **900** is provided with means for supporting a series of leaf springs **776a**, each corresponding to one of the reader cam levers **765** and each having its free end engaging one of said levers in such a way as resiliently to urge its reader cam **750** outwardly away from the needle cylinder. At a point to the left of the shaft **766**, as viewed, for example, in Fig. 4, the housing is provided with an arm or hook **903** to which one end of a tension spring **904** is attached, the other end of this spring being anchored to some fixed part of the machine frame, for example, to one of the columns which supports the bed plate C. This spring constantly tends to swing the housing in a clockwise direction about the shaft **766**, and as the levers **765** are urged outwardly by the springs **776a** carried by the housing, it is clear that if the housing be swung in the clockwise direction, it will carry the entire series of levers with it so that their cam ends **750** can no longer be caused to lie in the paths of the butts of the selector jacks by the action of the trick wheel.

The housing is also furnished with an outwardly projecting lug **905** (Fig. 4) carying an adjustable stop member **906**, here shown as a screw having a knurled head, and this screw is engaged by a cam **907** mounted on a vertical shaft **908** which is adapted to turn between pintles **909** and **910** (Fig. 1) carried by the bed plates C and B, respectively. This shaft **908** also has an arm **911** to which one end of a link **912** is secured. This link extends to the rear of the machine and at its end is furnished with a pair of spaced collars **913**, **914** (Fig. 2) which receive between them the forked upper end **915** of a lever **916**. This lever is pivotally supported by a stud **917** secured to one of the upright frame members of the machine, and has a lower forwardly projecting arm **918** which is bent inwardly and over the end of the pattern cylinder **120** and is adapted to engage cam lugs secured to this cylinder. The arrangement is such that engagement of a cam lug on the cylinedr with the member **918** will swing the lever **916** and, through the link **912**, will move the lever **911** (Fig. 4) in a clockwise direction, thus causing the cam **907** to press against the stop screw **906**, thereby forcing the housing to swing in a counterclockwise direction against the tension of spring **904**. In the absence of a cam lug on the pattern drum in position to engage the part **918**, a spring **916a** (Fig. 2) swings the lever **916** in a clockwise direction, thus swinging the cam **907** away from stop screw **906** and permitting the spring **904** to swing the housing with all of the parts supported thereby away from the needle cylinder. Preferably a stop member **919** carried by part **905**, is adapted, by engagement with shaft **908** for example, to limit outward swing of the housing.

The upper and lower plates 901 and 902 of the housing support between them a vertical stud 790a (Fig. 1) which carries a rotatable auxiliary pattern surface for working the levers 765. This pattern surface, in a preferred construction, consists of a slotted drum or "trick wheel" 791 having heads 792 and 793, (Fig. 16), of which the lower may be provided with a part having an annular undercut to receive one beveled end of any one of a series of inserted bits 794 held in by a spring band, such bits having projecting butts (or corresponding butt spaces) so arranged that each butt lies at the level of the lug 767 of one of the reader cam levers 765, it being understood that any of these butts or pattern indications on the trick wheel bit may be broken away when desired for patterning purposes.

This auxiliary pattern drum or trick wheel is arranged to be advanced either in the forward or reverse direction intermittently for patterning purposes, and such intermittent motion in either direction may be accomplished by the mechanism now to be described, although it is contemplated that other specific means may be designed for the purpose.

As here disclosed, the upper end of the trick wheel is provided with a pair of ratchet disks 800 and 800a, (Figs. 13 to 16), these disks having ratchet teeth which are turned in opposite directions, respectively. Preferably, the upper disk 800 is provided at one point with a low tooth 800t. These disks 800 and 800a are alternatively driven intermittently in opposite directions, respectively, by a pair of pawls 921 and 922, which are pivotally supported on a stud 921a carried by a lever 920 (Fig. 14) pivotally supported on the stud 790a which carries the drum,—this lever being mounted at a point above the upper plate 901 of the housing. Springs 924 connected to the respective pawls and to the lever arm 920 tend to hold the pawls in operative engagement with the teeth of their respective ratchet disks. Each of these pawls is furnished with a projecting finger 923 adapted to cooperate with pawl control devices hereinafter described.

The lever 920 has an arm 920a (Fig. 14) to which one end of a link 925 is pivotally connected. This link extends toward the rear of the machine, and at its rear end is pivotally secured to the upper end of a rocker arm 926 (Fig. 2) secured to a shaft 927 (Fig. 4) mounted in bearings carried by the bed plate B and the frame A, respectively. This shaft extends to the right-hand side of the machine frame, and at its right-hand end (Fig. 3) is provided with a pair of rocker arms 928 and 929 extending forwardly and rearwardly, respectively. The arm 928 carries a stud 930 upon which a cam follower lever 931 is pivotally mounted. The upper end of this lever 931 is furnished with an adjustable eccentric stop 932 adapted to engage the hub of the lever 928 so as adjustably to determine the angular position of the lever 931.

A bracket 933 projects rearwardly and downwardly from the frame A, and at its lower end pivotally supports a cam follower lever 933a. A link 934 is pivotally secured at its lower end to the cam follower lever 933a and at its upper end is slotted to receive a stud 935 carried by the arm 929. An eccentric stop member 936, carried by the link 934, is adapted to engage the stud 935, thereby adjustably to determine the effective length of the link 934.

The free ends of the cam follower levers 931 and 933a lie in the paths of revolution of cams 931a and 933b, respectively, secured to the central portion 65a of the high speed gear 65. This latter gear makes one revolution for each four revolutions of the needle cylinder and accordingly each of the cam follower levers 931 and 933a is actuated once for each two revolutions of the needle cylinder. Thus the shaft 927 is rocked forwardly and backwardly during each two revolutions of the needle cylinder, so that each of the pawls 921 and 922 is moved forwardly to advance the corresponding ratchet disk once for each two revolutions of the needle cylinder. Obviously by placing two additional cams on the gear 65, the ratchet disks may be advanced one step for each revolution of the needle cylinder or, by omitting one of the cams, for example, the cam 933b, the ratchet disks may be advanced but once in four revolutions of the needle cylinder. By reason of the relative locations of the several pivotal connections, the rocking movement of the pawl carrying lever 920 is not substantially affected by the relatively small angular movement of the housing necessary to move the trick wheel out of operative relation to the needle cylinder.

For determining the times of effective operation of the two pawls 921 and 922 the following mechanism preferably is employed, it being understood that any equivalent means for accomplishing the same result is to be regarded as within the purview of the present invention. As here illustrated, the bed plate C is furnished with a depending stud 937 (Figs. 4 and 12) carrying a pair of pawl controlling levers 938 and 939, respectively, which are held in spaced relation by means of a sleeve 940. The lever 938 is furnished with a depending pin 938a and the lever 939 is provided with an upstanding pin 939a, these pins being so disposed as, at times, to engage the fingers 923 of the respective pawls 921 and 922.

The lever 938 is furnished with an arm 938b having a depending pin 940, while the lever 939 has an arm 939b provided with an upstanding pin 940a. A bracket 941 (Fig. 1) suitably supported by the bed plate C carries a stud 941a (Fig. 12) on which turns, in a vertical plane, a lever having three arms 942, 943 and 944, respectively. The arm 942 is provided with a stud forming a pivotal support for one end of a link 945 (Fig. 4) which extends through an opening in the stud 940 of the lever 938b and is furnished at its forward end with a stop collar 946 (Fig. 12). A coiled spring 947 encircles the link 945, bearing at one end against the stud 940 and at its other against an enlargement of the link 945, the arrangement being such that forward movement of the link 945 tends to compress the spring 947 and thus, by the resilient pressure of the latter, to swing the stud 940 and lever arm 938b forwardly.

The arm 943 of the three-armed lever above referred to has a stud to which one end of the link 950 (Fig. 12) is secured, such link passing freely through an opening in the stud 940a and having a stop collar 951 at its forward end and being encircled by a coiled compression spring 952. Thus forward movement of the lower arm 943 of the three-armed lever tends resiliently to swing the stud 940a and lever arm 939b forwardly.

The rear arm 944 of the three-armed lever is pivotally connected to the upper end of a link member 953 (Fig. 12) whose lower end is pivotally connected to a rocker arm 954 (Fig. 2) having a hub portion which is free to turn on the belt shipper shaft 93. A spring 955 tends to swing the arm 954 downwardly. The hub of the

arm 954 (Figs. 1 and 2) is provided with a pair of forwardly directed arms 956 and 815, respectively. The arm 956 is furnished with an adjustable cam follower 957, (Fig. 2), here shown as a screw having a lock nut for holding it in adjusted position, and this cam follower screw lies in the vertical plane of rotation of a cam 820 conveniently secured to the gear (at the left-hand end of the shaft 80) which transmits motion to the pattern drum 120. The arm 815 (Fig. 1) is provided with a stud 958 which lies in the path of pattern lugs 63 at the left-hand side of the links 60 of the primary pattern chain.

In order to prevent actuation of the auxiliary pattern drum or trick wheel, with consequent variation in the pattern during the knitting of heels and toes, I provide safety mechanism adapted to hold both pawls 921 and 922 out of action while heels and toes are being knit. For this purpose the usual gap closer thrust bar 460^a is furnished with a special cam 960 (Figs. 2 and 12) adapted, when the thrust bar is raised for closing the gap in the latch ring at the beginning of reciprocating knitting, to engage one end of a lever 961 pivotally supported on a stud 962 (Figs. 4 and 12) carried by the bed plate C and having arm 963, which is connected by a link 964 to a lever 965, mounted on the sleeve 940. This lever 965 is of T-shape, having the vertical member 966 (Fig. 12) which is adapted simultaneously to engage both arms 938^b and 939^b of the pawl controlling levers. Thus when the thrust bar 460^a is raised at the beginning of the heel and toe, respectively, the cam 960 causes the link 964 to move rearwardly,—swinging the plate 966 into engagement with both of the arms 938^b and 939^b so as to swing the pawl controlling levers in a counterclockwise direction (Fig. 14) and causing their studs 938^a and 939^a to engage the fingers 923 of both pawls, thereby swinging both pawls out of operative engagement with the ratchet disks so as positively to prevent further motion of the trick wheel during reciprocating knitting.

When the cam follower 957 (Fig. 2) rests on the cam 820, the lower pawl 922 is held out of action, while the pawl 921 is allowed to move inwardly only far enough to engage teeth of normal length on the ratchet disk 800, so that when the low tooth 800^t comes into the field of movement of pawl 921 the disk 800 stops. Thus, during the formation of waste courses between stockings, the cam 820 so holds cam follower 957 that disk 800 may be pawled around to its proper starting point and then left stationary preparatory to beginning the pattern.

When the cam 820 rides out from under the member 957 the pawls 921 and 922, respectively, are allowed to act in accordance with the presence or absence of a chain lug 63 in cooperative relationship to the member 958. If a chain lug engages the member 958 when the member 957 runs off of cam 820, the rod 953 is thereby elevated sufficiently to swing lever arm 942 forwardly. This resiliently urges the stud 940 forwardly and pushes the pin 938^a out of the path of finger 923 of the pawl 921 so that the latter may move all of the way in to engage the lower tooth 800^t and thus start the pattern drum. At the same time the lower lever arm 943 moves rearwardly, pulling the arm 939^b backward and, by means of pin 939^a, pulling the pawl 922 out of action. So long as lugs on the chain 60 continue to hold the rod 953 elevated, the pattern drum will continue to be pawled forwardly and the fabric will be patterned in accordance with the indications of successive tricks of the pattern or trick wheel. However, to reverse the trick wheel it is merely necessary to let rod 953 drop, by omitting a lug 63 from the chain 60 at the desired point. As the rod 953 drops, the lever arm 942 is rocked backwardly thus pulling pawl 921 out of action while at the same time the lower lever arm 943 rocks forwardly, thus permitting pawl 923 to engage the teeth of the ratchet disk 800^a and by cooperating therewith to turn the trick wheel in the reverse direction to produce a reverse pattern in the fabric.

It may be noted that if the rod 953 is raised by a single lug on the chain 60, at a time when cam 820 is disposed beneath the member 957, the trick wheel will start into forward movement, and that this movement will continue even in the absence of other lugs on the chain, until the low tooth 800^t is brought around into the field of action of pawl 921.

As an example of the capabilities of the machine for pattern formation, reference is made to Figs. 9 to 11 inclusive, wherein there is illustrated a suitable arrangement of selector jack butts and trick wheel indications arranged to make a pattern of the type shown in Fig. 10.

Let it first be assumed that a selector jack is placed under every cylinder needle and that each such jack originally provided with twenty-six butts has had all butts broken away except the lowermost one and those necessary for making the intended pattern. As usual, the lowermost butts 702 of the jacks are employed in making selvages etc., the butts 702 on alternate jacks being broken away and the remaining butts cooperating with the cam (not shown) which is actuated by lever 761 and controlled by cams on the end of the drum 120 as above described. The remaining twenty-five butts or butt spaces lie at twenty-five different levels and the butts disposed at any given level may for convenience be referred to as a "row" of butts. At the level of each such row there is arranged one of the reader cam levers 765 with its butt-engaging cam 750, while the outwardly projecting lug 767 of each reader cam will lie at the level of a horizontal row of pattern indications on the trick wheel. Each bit of the trick wheel has twenty-five butts or corresponding butt spaces which are here diagrammatically designated by the letters A to Y inclusive, beginning at the top of the series (Fig. 9), and in the example chosen for illustration the trick wheel has 48 of these bits. The selector jack butt levels are correspondingly lettered A to Y inclusive, in Fig. 11, the lowermost level Z controlling the selvaging butts 702, as above referred to. In producing the pattern now to be descibed, all butts or pattern indications on the trick wheel are broken away except one on each bit.

As already noted, the trick wheel may be moved intermittently either forward or backward at various predetermined intervals, for instance, one step for each course of knitting, or once for each several courses, for example, each second course or each fourth course as desired, so that a new bit of the series of forty-eight may be presented in operative relation to the selector jack butts at any of said predetermined intervals. The trick wheel may also be moved bodily out of action, carrying the reader cam levers with it, but while out of action the trick wheel may be caused, if desired, to continue its intermittent motion in one direction or the other or to reverse

its motion so that when restored to action any selected bit may be ready to take up the operation of controlling the pattern selection.

Fig. 10 is a diagram or chart useful in determining the proper arrangement of selector jack butts and pattern indications on the trick wheel necessary to produce a given pattern. In making this chart it is assumed that each horizontal row of squares represents a needle, or the stitch produced by a given needle, while the vertical rows of squares represents successive courses of knitting. In making ready to set up the machine for producing a pattern such as that shown in Fig. 10, for example, wherein the pattern effect is produced by special stitches, for instance float stitches upon a plain ground of normal knitted fabric, it is convenient to blacken or fill in each square representing a stitch at which a special stitch effect is to occur.

The number of needles which can take part in a pattern bears a definite relation to the number of bits in the trick wheel and the number of butts on the selector jacks. In the present instance the maximum width of a single pattern repeat is forty-nine needles, but obviously several like patterns may be spaced circumferentially around the knitted tube dependent upon the number of needles in the machine. Obviously a lesser number than forty-nine needles may be concerned in making any given pattern repeat, but if the maximum number just referred to be employed, the pattern must be symmetrical with reference to a given wale of the fabric.

The length of any given pattern repeat is determined by the frequency with which the trick wheel is stepped along. Thus if the trick wheel moves once for each course, only forty-eight courses of stitches can be concerned in any given repeat (provided the movement of the trick wheel is continuous in one direction). However, if the wheel be turned but once in two courses, the pattern repeat may extend over ninety-six courses, and if the wheel turns once in four revolutions of the cylinder the pattern may extend over one hundred ninety-two courses.

Assuming that a symmetrical pattern is to be made and that the needle designated A (Fig. 10) is that which will knit the center line of the pattern,—the pattern diagram may be laid out as indicated. It will be noted that at the extreme left-hand end of the design, as shown in Fig. 10, the needle A alone knits a special stitch; that in the next course the needle A and the needles B at each side of it will knit special stitches; and that in course 3, only the needles D at each side of the center line will knit special stitches. It will also be noted that after the formation of course 5, the pattern is reversed so that course 10 corresponds to course 1. However, course 10 also constitutes the beginning of a new and different pattern repeat which extends to course 16 and then also reverses.

To produce this pattern by a continuous forward motion of the trick wheel, all of the butts A to Y of the selector jacks, except one for each jack, are removed. Assuming that the needle corresponding to jack 25 (Fig. 11) is to produce the center wale of the selected pattern, the jack 25 will have remaining only a single butt at the level A. The selector jacks 24 and 26 will each have a single butt at the level B, and the selector jacks 23 and 27 will each have a single butt at the lever C etc., it being noted that between jacks 1 and 49 a single blank jack is left to separate adjacent patterns widthwise of the fabric.

In arranging the pattern lugs on the bits of the trick wheel for producing the pattern of Fig. 10, the chart shown in Fig. 9 is convenient. Assuming that the entire pattern, as shown in Fig. 9, is to be made by continued forward advance of the trick wheel, the first bit corresponding to the jack 25 which is to make the center wale of the design will have a single lug disposed to engage and actuate reader cams at the jack butt level A, so that engagement of the pattern indication on this bit of the trick wheel with the butt of jack 25 at level A will cause this particular jack to miss the cam 741 so that its needle A (Fig. 10) will take one of the special paths t or t' (according to the position of cam 382) to form a patterning stitch. Assuming that the trick wheel is to step forward once for each knitted course, the next bit of the trick wheel will have lugs or pattern indications at levels A and B respectively, so that when this bit is in operative position, it will cause the jack 25 and the jacks 26 and 24 at opposite sides thereof to miss the cam 741. The next bit in the trick wheel will have a lug or indication at the level C only, and will thus coact with the reader cam lever which actuates the butts of the jacks 23 and 27 at the level C.

For knitting the entire pattern shown in Fig. 10, but seven needles are required and the two pattern repeats there shown only need twenty-three of the forty-eight bits in the trick wheel in its production. Thus in making relatively short pattern repeats it is obvious that several different patterns may be laid out in succession about the circumference of the trick wheel. However, to save space on this wheel, thereby permitting the making of longer and more complex patterns in succession, the reverse movement of the wheel is of great value. Thus if it be assumed, for example, that the trick wheel has been reversely driven in making courses 1 to 5 of the first pattern figure M, (Fig. 10) the remainder of this pattern figure, covering courses 6 to 10, can be produced merely by causing the trick wheel to change its direction and advance forwardly, and thus only five bits may be made to accomplish the same results as ten bits if the wheel had been advanced continuously in one direction. Obviously the same pattern figure M can be repeated in succession as many times as desired, by repeated reverse and forward movements of the trick wheel. Then at the end of such a repeat of the first pattern figure M, the wheel can be advanced further and by the use of a new series of bits, the first half of another pattern figure N can be made, the second half of which is produced by reverse movement of the trick wheel, etc.

Fig. 8 illustrates a stocking knitted by the use of the machine herein disclosed. This stocking has a pattern forty-nine wales in width and symmetrical with respect to a wale at one side of the stocking. This pattern comprises an upper figure A having a portion a' knitted, for example, during reverse movement of the trick wheel, followed by a part a^2 (the reverse of part a') produced by forward rotation of the trick wheel. This first figure is directly followed by a second figure B having an upper part b' produced by continuing the forward movement of the trick wheel after the completion of pattern figure A, and a lower part b^2 produced by reverse drive of the trick wheel. If now the trick wheel continues its reverse movement it will produce another repeat of the figure A, or at least the part a' thereof, and if after the completion of this part a' of figure

A the wheel continues its reverse motion, it may be caused to produce a third figure C.

Evidently by the provision of various arrangements of pattern indications in the trick wheel a wide assortment of pattern effects may be produced, since by the use of the reverse drive of the trick wheel, it is possible, without unduly increasing the diameter of the latter, to make many and complicated patterns. This capability is further enhanced by the fact that the trick wheel may be moved bodily away from the jack cylinder under pattern control, as above described, so as, if desired, to intermit a pattern figure at any desired point, and to continue the figure after a desired interval by merely restoring the trick wheel; or portions of any given pattern figure may be wholly omitted by continuing to turn the trick wheel while the latter is removed from its operative position. Instances of such modes of operation are illustrated in Figs. 17 and 18, where it is shown how, by the employment of a pattern set up primarily designed to make a single triangular figure, (Fig. 17) or two such figures of different angles (Fig. 18) it is possible to produce patterning effects of extended length and in a wide assortment of combinations.

When the patterns are less than twenty-five needles wide the jack butts may be arranged in a single diagonal row as shown at the left of Fig. 11, and when thus arranged it is possible to knit a greater number of patterns widthwise of the fabric. It is also possible to knit patterns of greater width than forty-nine wales by arranging the selector jacks in groups of two or more, each jack of a group having butts at the same level, but the possibilities of this arrangement are somewhat limited by the lengths of the floats thereby produced.

In lieu of the above-described mechanism for actuating and controlling the trick wheel, an arrangement substantially as indicated diagrammatically in Fig. 19 may be employed. In this figure the usual striper drum **20**, which, by appropriate devices (not shown) common to the Scott & Williams type of knitting machine, may be stepped forward intermittently once for each course or group of courses of knitting, is provided with two series of cams, each arranged, (through appropriate mechanical connections) independently to actuate one of the ratchet driving pawls **921**×, **922**×, respectively. In this case the presence of a cam lug in one of these series on the drum **20** will actuate the corresponding pawl and thus move the trick wheel forward or backward one step as the case may be, while the absence of a corresponding cam lug in the adjacent series leaves the other pawl idle. Obviously each pawl may thus be actuated at will and in any desired sequence by a proper arrangement of cam lugs on the drum **20**, and both pawls may be made inactive simultaneously by omitting cams at corresopnding points in the two series.

Other and equivalent arrangements for driving the trick wheel in the desired manner will be obvious to those skilled in the art as equivalents of the arrangements herein specifically described and are to be considered as falling within the purview of the invention as set forth in the appended claims.

We claim:

1. A circular knitting machine having a needle cylinder carrying needles and movable instrumentalities for selectively actuating the needles, a pattern drum having indications normally operative to determine selective movement of said instrumentalities, pivotally mounted motion-transmitting levers interposed between the indications of said drum and said instrumentalities, a common, movable support for the drum and said motion-transmitting levers, and pattern controlled means operative to move said support, with the drum and the motion-transmitting levers, away from the needle cylinder.

2. In a knitting machine in combination with knitting needles and controlling devices therefor, including a selector jack having a series of projecting butts, a movable pattern surface, a bank of motion-transmitting levers corresponding to the series of jack butts, respectively, each lever having a portion normally interposed between a selector jack butt and the pattern surface, means tending to swing the levers away from the selector jack butts and toward the pattern surface, a common, movable support for the pattern surface and the bank of levers, and pattern controlled means operative at times to move the support, thereby simultaneously to carry the pattern surface and the bank of levers bodily away from the jack butts.

3. In a knitting machine having a needle cylinder and needles therein, in combination, pattern mechanism for determining special actuation of selected needles to form a predetermined pattern figure in the fabric, said pattern mechanism including a pattern drum mounted to turn about an axis substantially parallel to that of the needle cylinder, a movable support for said drum, said support being movable bodily toward and from the periphery of the needle cylinder, and motion-transmitting levers interposed between the periphery of the drum and the periphery of the needle cylinder, said motion-transmitting levers being pivotally mounted on said movable support whereby movement of the support away from the needle cylinder carries the drum and the motion-transmitting levers simultaneously away from the needle cylinder.

4. A knitting machine comprising knitting instrumentalities and pattern means for causing a special actuation of selected ones of said instrumentalities whereby to produce a pre-determined pattern figure in the fabric, said pattern means comprising a series of selector jacks having selector butts disposed in definite rows longitudinally of the jacks, a pattern drum having corresponding rows of pattern indications, a motion-transmitting lever corresponding to each row of pattern indications, each of said motion transmitting levers being arranged for engagement by the pattern indications of a predetermined row thereby to move jack butts of the corresponding row, a common support for the pattern drum and for said motion transmitting levers, said support being movable, and pattern controlled means for moving said support toward and from the rows of jacks whereby simultaneously to carry the drum and the motion-transmitting levers toward and from the jacks.

5. A circular knitting machine having a needle cylinder, needles therein, and controlling means for specially actuating certain of said needles for the formation of a predetermined pattern figure in the fabric, said controlling means including a pattern surface eccentric to the needle cylinder, a series of motion-transmitting levers interposed between the pattern surface and the needle cylinder drive means operative alternatively to move said pattern surface in opposite directions, respectively and means operative to move said pat-

tern surface bodily into and out of operative relation to the needle cylinder.

6. A knitting machine comprising knitting instrumentalities and controlling means for controlling and specially actuating certain of said knitting instrumentalities for the formation of a predetermined pattern figure in the fabric, said controlling means including a series of selector jacks having butts disposed according to a predetermined arrangement, and a movable pattern surface having indications operative to determine the position of the jacks, a series of pivoted levers operative to transmit movement from the pattern surface indications to the jack butts, drive means operative alternatively to move said pattern surface in opposite directions, and means to move said pattern surface bodily into and out of operative position.

7. A knitting machine having in combination knitting instrumentalities, selector jacks associated with certain of said instrumentalities, a rotary pattern drum having pattern indications cooperable with the jacks for selectively positioning the latter, a pair of pawls and ratchet means secured to the drum for cooperation with the pawls, one pawl being operative to drive the drum in one direction and the other pawl operating to drive the drum in the other direction, means for actuating both pawls, means operative to hold said pawls alternatively out of action, and means operative to hold both pawls simultaneously out of action.

8. In a circular hosiery knitting machine having a needle carrier and needles therein, in combination, pattern mechanism operative to determine special actuation of selected needles for the production of a predetermined pattern figure in the fabric, said pattern mechanism including a rotary pattern drum, a primary pattern surface comprising a mutable link chain and connections actuable thereby for timing the sequence of principal events in the knitting operation, a rotary cam which turns one complete revolution for each article knitted, and means controlled mutually by said cam and the primary pattern surface to determine the stopping of the rotation of the drum.

9. A knitting machine comprising knitting instrumentalities, means including a rotary pattern drum having indications arranged for specially actuating selected ones of the knitting instrumentalities for the repeated production of a predetermined pattern figure in the knitted fabric, a series of pivotally mounted motion-transmitting levers actuable by the indications on the pattern drum, means operative to turn said drum alternatively in opposite directions, and means operative to make the pattern device inactive at any desired point in the production of any selected repeat of the pattern and after a predetermined interval of time to restore it to operation.

10. A knitting machine comprising knitting instrumentalities and controlling means for specially actuating certain of said instrumentalities for the production of a predetermined pattern figure in the fabric, said controlling means including a movable pattern surface which, when in operative position, determines the contour of the pattern figure to be produced, means for rendering said pattern surface inoperative with respect to control of the knitting instrumentalities, and means operative to move said surface in either a forward or reverse direction while such surface is either operative or inoperative, respectively, with respect to the knitting instrumentalities.

11. A hosiery knitting machine comprising knitting instrumentalities and means for actuating said instrumentalities in predetermined orderly manner in the production of leg, heel, foot and toe fabric, and controlling means for specially actuating certain of said instrumentalities for the production of a predetermined pattern figure in the fabric, said controlling means including a rotary drum having pattern bits, a pair of pawl and ratchet devices operative respectively to turn the drum in opposite directions, pattern means for determining which of said pawl and ratchet devices is at any time to be operative to turn the drum, and means operative at the beginning of heel and toe knitting, respectively, to render both of said pawl and ratchet devices inoperative.

12. A circular hosiery knitting machine comprising knitting instrumentalities, including needles, yarn guides, a latch guard ring having a gap therein for the reception of yarn guides and a gap closer operative to close said gap at the beginning of heel and toe knitting, respectively, and controlling means for specially actuating certain of the knitting instrumentalities for the production of a predetermined pattern figure in the fabric, said control means including a movable pattern surface, drive means operative to drive the pattern surface alternatively in opposite directions, and means operating in time with the movement of the gap closer into gap closing position to throw both of said drive means out of action.

13. In a knitting machine having a rotary needle carrier and needles therein, in combination, pattern mechanism operative to determine special actuation of selected needles for the production of a predetermined pattern figure in the fabric, said pattern mechanism including a rotary pattern drum, a pair of ratchet disks fixed with relation to the drum, said disks having their teeth turned in opposite directions, respectively, pawls cooperable with the two ratchets, respectively, to drive the drum in opposite directions, means for operatively moving the pawls once for each of a predetermined number of revolutions of the needle carrier, a pair of movable supports each carrying a controller adapted, at times, to hold one of the pawls, respectively, out of cooperative relation to its ratchet, and pattern control means operative to move said supports simultaneously or alternatively, respectively, whereby to move both pawls out of action at the same time, or alternatively, to move either of said pawls out of action independently.

14. A circular knitting machine comprising knitting needles and pattern means for controlling predetermined actuation of selected ones of said needles for the formation of a predetermined pattern figure, said pattern means comprising a pair of rotary pattern drums disposed to turn about substantially parallel axes, each drum having corresponding rows of selector elements, the selector elements of one drum being radially movable, a bank of pivotally mounted levers interposed between said drums, each lever being operative to transmit motion from the selector elements of one drum to the movable selector elements of the other, a movable support for one of said drums, means for driving said latter drum intermittently in either direction during the formation of said pattern figure, means operative to move said support thereby to carry the latter drum away from the other drum, and pattern means for determining the direction of rotation of said latter drum.

15. A circular knitting machine comprising knitting needles, and controlling means for controlling and specially actuating certain of said needles for the formation of a predetermined pattern figure in the fabric, said controlling means including a pair of cooperating pattern surfaces, and a series of pivotally mounted motion-transmitting levers operative to transmit motion from one pattern surface to the other, drive means operative alternatively to move one of said surfaces in opposite directions during the formation of said pattern figure, means supporting one of said pattern surfaces for bodily movement toward and from the other, and means operative to move said supporting means during the actuation of said latter pattern surface by its drive means.

16. A circular knitting machine comprising knitting needles, and controlling means for controlling and specially actuating certain of said knitting needles for the formation of a predetermined pattern figure in the fabric, said controlling means including a pair of cooperative pattern surfaces, a series of pivotally mounted levers operative to transmit motion from one of said pattern surfaces to the other, one of said surfaces being carried by a rotary drum, a movable support on which the drum is mounted, pattern control means operative to move said support with the drum toward and from the other pattern surface, pawl and ratchet means operative to drive the drum alternatively in opposite directions during the formation of said pattern figure, and pattern responsive means for determining the direction of rotation of the drum.

17. A knitting machine comprising knitting instrumentalities, a pattern drum and means for turning the drum, said drum having indications for controlling the special actuation of selected knitting instrumentalities for making repeats of a predetermined pattern figure in the fabric, and means operative to remove the pattern drum from controlling relation to the knitting instrumentalities, the drum turning means being operative to turn the drum in either direction while so removed from operative position.

18. A knitting machine comprising knitting instrumentalities, and pattern means for controlling predetermined actuation of selected ones of said instrumentalities, said pattern means comprising a pair of rotary pattern drums, one of said drums supporing a series of radially movable jacks and the other drum having a series of relatively fixed bits, said jacks and bits having corresponding rows of selector elements, a series of motion-transmitting levers interposed between the selector elements of the two drums, each such lever being operative to convert relative circumferential motion of the selector element of a bit and the butt of a jack into radial movement of the jack, a common support for the bit-carrying drum and the motion-transmitting levers, means for moving said support so as simultaneously to separate the motion-transmitting levers and the drum from the jack butts, and means operative to turn the bit-carrying drum irrespective of the position of the support.

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